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ABSTRACT

This paper presents a description of a northern Florida middle school and of the students enrolled in the school, 92% of whom are African-American. Three quarters of the entire student population is eligible for free or reduced price government assisted lunches. This figure is double the state average. During academic year 1991-92, expenditure per student enrolled within regular academic programs was 12% below the state average or $2,920 per student. Observations of an eighth-grade physical science class, a sixth-grade mathematics class, and an eighth-grade science assembly are related. Interviews with the science teacher and mathematics teacher from these classes are given along with a list of needs generated from mathematics and science teachers. Traditional methods of teaching prevailed in these classrooms. (MKR)

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Mathematics and Science Learning Milieus in Diverse Schools in Florida: African-American students from small town, low socio-economic backgrounds.

The Florida State University
Science and Mathematics Education Program
Scott Robinson

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American Educational Research Association
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Introduction

The purpose of this paper is to offer a glimpse into the world of a poor, southern U.S., predominantly African-American public middle school (grades 6-8). In particular I focus on what happened in a mathematics and science classroom and a grade eight science assembly in the spring of 1993. It is important to note that I was raised in a middle class, midwestern U.S., Caucasian community and attended a public middle school that demographically and economically reflected that same community. Therefore, I do not suggest to completely understand the cultural milieu presented in this paper. In addition, I do not claim to hold an impartial, objective, or what Clandinin (1994) refers to as the 'god's eye view' of the world. However, observations and interviews with teachers and a school administrator may offer insights upon the *context* of a mathematics and science classroom at one northern Florida middle school from my perspective. I hope that my modest interpretation may assist educational reformers as they attempt to include culturally diverse student populations into the mathematics and science education initiatives currently underway in Florida.

My descriptions are from the perspective of an outsider looking upon a classroom context for the first time. My field notes and mental impressions are personal constructions or as Geertz writes, "that what we call our data are really our own constructions of other people's constructions of what they and their compatriots are up to" (1973, p.9). I have constructed my role as an interpretative researcher in the spirit of Geertz's (1973) view on interpretive ethnography. Accordingly, the following descriptions of what went on in a mathematics and science classroom are purely my subjective interpretations.

Student/School characteristics

To begin, I would like to introduce the general characteristics of the middle school and the students enrolled within the school. This information was obtained from a Florida Department of Education (1992) report.

More than 1200 students are enrolled across grades 6 through 8 within this small town middle school located in the panhandle region of Florida. Roughly 92% of students are of African-American ethnicity. Three quarters of the entire student population are eligible for free or reduced price government assisted lunches. This figure is double the state average. During academic year 91-92, expenditure per student enrolled within regular academic programs was 12% below the state average or $2,920 per student. The Florida Department of Education has classified this school as a High Priority Location Site due to the high percentage of students receiving free

and reduced lunches and the high rate of teacher turnover. Teachers employed at this and other High Priority Location Sites are eligible for state and federal education loan absolution.

Grade 8 science rooms in the main school building were under renovation during my visits. Thus grade 8 science classes were temporarily held in portable trailer classrooms located on the school grounds. The library was also closed for renovations. Construction work on the library, which began at the start of the 1992-93 school year, ought to be completed for the next school year. Science classroom construction was scheduled to be completed during the spring 1993 school semester.

Each grade 8 teacher had an IBM computer in their classroom. Grade 6 mathematics and English classes had access to a resource room containing 18 Apple computers. Computer education classes were offered as a grade seven elective. Students enrolled in this course shared 12 computers within a portable trailer classroom.

A grade 8 physical science class and grade 6 general math class were observed. Mr. Jones, the physical science instructor, had 22 years of teaching experience in this district. Ms. Smith had 12 years of teaching experience including 7 years at this school. Ms. Smith teaches grade 6 mathematics and science. (Mr. Jones and Mrs. Smith are fictitious names for the teachers who were interviewed and observed.)

Observations/Interview with science teacher

Upon arriving at the middle school, I walked across a crumbling black asphalt lot which was being used as a playground. A group of nine African-American middle school age boys were kicking and chasing a soccer style ball beneath a rimless basketball backboard at one end of the paved lot. I strolled across the playground to a sidewalk leading to a series of elevated double wide trailers. I followed the sidewalk and glanced at a patchy grass and sand covered landscape with 4 to 12 inch deep erosion ruts and channels carved into the exposed ground. The portable trailer classrooms were neatly arranged in two rows with four trailers in each row. Classroom trailers were elevated 4 feet above the ground by being seated upon a series of stacked gray concrete construction blocks. I approached and climbed a set of wooden stairs to enter the portable grade 8 science classroom where I was to meet and observe Mr. Jones and his grade 8 science students.

I opened the trailer door and entered the room. Thirty-two grade eight physical science students were seated at individual desks copying notes

from textbooks onto white sheets of lined notebook paper. I quietly walked to the back of the room and sat at an empty student desk. Mr. Jones told me that students were copying definitions from their textbooks to complete an assignment. My initial impression was that students were well behaved as they quietly completed their textbook assignments.

After glancing about the room, I soon became aware of the sound of music emanating from a small bookshelf near my seat. However, what I heard did not resemble a Rogers and Hammerstein score, rather this was an urban contemporary jazzy rock sound. This background music was softly heard over the sounds of students jostling notebook papers, turning textbook pages, and shifting about in their seats. The radio volume was set low yet the sound was audible throughout the room. Music did not appear to disrupt the students as they quietly worked at their individual desks. I believe the teacher used music to help create a more relaxed, informal atmosphere while students performed quiet seat-work assignments. I had, at times, played a radio when I taught grade 9 general science and discovered that students often work well with a radio quietly playing in the background.

Mr. Jones walked about the room and stopped to speak to students who had raised their hand into the air. Students raised their hands to notify the teacher that they had a question about their assignment. The teacher constantly paced the floor making frequent stops to answer student questions about the assignment. Most students worked alone; however, a few were paired together and shared a science textbook.

Twenty minutes into the class period, Mr. Jones walked to the front of the room and wrote four chemical formulas on the front chalkboard including: NaCl. Then, he asked the entire class to identify the elements contained in this molecule. One student raised her hand and Mr. Jones called her by name. The student replied, "Isn't that some kind of element?". Mr. Jones replied, "Well, it is made of two kinds of elements...". His comment was cut short by another student who blurted out "I think that is a mineral or something". The teacher reported that these letters stood for a molecule. Mr. Jones asked the class, to name the molecule. A few seconds later, he answered his own question and said, "this is common table salt, like the kind you sprinkle on French fries". Later, in the school cafeteria, I learned that French fries could be purchased for lunch each school day.

After a brief two minute lecture on the nature of chemical formulas, students were instructed to continue reading and answering textbook assignments. Students continued to work quietly. However, fewer and fewer students remained on task as the final 10 minutes of the class period

elapsed. By the end of the period many students were busy either discussing non school related topics or resting their head on their desktop with their eyes closed.

I noticed that this trailer did not have a water faucet or a sink. A large TV with attached VCR was located near the front of the classroom. A small closet provided a rather limited amount of storage space for science equipment. Student desks came in many different styles and sizes in this classroom. A six foot tall student was seated at a desk, which by the size of it, probably was designed for an elementary classroom. His knees were pressed against the underside of the desk which caused the front legs of the desk to rise precariously off the floor. He looked cramped and confined in this undersized desk.

After students had been dismissed from the class, I asked Mr. Jones what might be done to improve science learning for his students. He replied that students would benefit from a science research course elective offered at each grade level within the school. Students could conduct some kind of experimental research project in this class. He also desired money for field trips. About class size, Mr. Jones said that he had a total of 190 students in five classes. He would rather have had this number of students distributed among six classes to reduce class size. His largest class contained 39 students.

I also learned that Mr. Jones served as director of the school and regional science fairs. He spends a considerable amount of personal time organizing these events. He has taken qualifying students to the national/international science fair competition in other states. He sponsors Saturday field trips for those students who achieve high marks during a given grading period. Many of his students are invited to a backyard cookout/swimming party at his home at the end of the school year. He said that over 100 students attended the end of the year celebration last year.

Mr. Jones supplemented the science text with local and regional curriculum materials including local hydrological maps and surveys for water studies. He was a contributing member of *Project Wet*. This hypercard computer software science curriculum package contained 5 innovative projects dealing with the water cycle. He will help decide what kinds of lessons were to be included in this computer program.

In addition to science teaching, Mr. Jones was responsible for a 45 minute homeroom period at the beginning of each school day. Other daily tasks

include escorting and chaperoning students to and from the cafeteria during a 25 minute lunch period.

Observation/Interview with mathematics teacher

After my visit with Mr. Jones, I walked to Ms. Smith's grade six mathematics class. She teaches four science and two mathematics classes. Her room contained rows of neatly arranged student desks. Posters of dinosaurs, famous black Americans, and mathematics heuristics were hung on side classroom walls. She had a number of indoor potted plants positioned on a shelf beneath a series of windows which made up one half of the rear classroom wall. I visited her class immediately after students had eaten lunch. There were 32 grade six students in this class. Before class began, students quietly filed into the room to gather their books and school materials from lockers lining one half of the back classroom wall.

Students were given a worksheet on fraction addition at the beginning of the class period. Ten minutes later, Ms. Smith wrote sample worksheet questions on the front chalkboard and explained, step-by-step, how to solve these kinds of problems. Students raised their hand to be called upon to respond to Ms. Smith's numerous questions during her presentation. After an introductory explanation and question & answer period, students directed their attention back to their worksheet assignment. While students worked, Ms. Smith walked about the room and spoke with those who raised their hands for assistance. Each student worked quietly at their seat until the end of the class period. After the students had been dismissed from class, Ms. Smith told me that she would like to have more mathematics and science supplies to enhance the mathematics and science curriculum. She has 5 classes with as many as 36 students in a given class.

Interview with administrator

When asked about improving math and science learning, Ms. Cooper replied "we need more hands-on materials in science and mathematics". Mrs. Cooper was the grade 6 coordinator at this middle school. She believes there exists a school wide need to correlate what student learn from one grade to the next. For instance, she felt a significant number of students were not placed in the appropriate mathematics course. Ms. Cooper explained the school operated under a "team approach" management concept. Each child belonged to an interdisciplinary team of teachers comprised of a representative teachers from social studies, math, science, and language arts. Team teachers met weekly to discuss concerns about academic content, individual student progress, discipline, and current issues.

Needs

The following set of needs was generated from mathematics and science teachers. A nominal group technique of achieving consensus was conducted among the participating teachers. Needs are prioritized from most to least important.

Mathematics	Science
Better preparation for students	Smaller classes
Smaller classes	Better preparation for students
Teacher education	Incorporation of technology
More individualized instruction	Grade 6 science laboratories
Hands-on materials	More individualized instruction

Two categories of need were common to both mathematics and science teachers. These teachers included smaller classes and better prepared students as high priority concerns. Nearly all seventh and eighth grade mathematics and science students, except new arrivals, attended this school during the preceding year. It would appear that mathematics and science teachers need time to jointly plan a curriculum which enhances student grade level transitions. Likewise, members of the science and mathematics teaching staff may wish to meet with teachers from feeder elementary schools to discuss what each child should know about their subject upon completing grade five.

A generalized precondition of encouraging individualized instruction includes having fewer students in each class. With fewer students, teachers believe they will be able to apportion more time to each child. However, some educators contend that alternative teaching strategies including cooperative learning and project activities may enable teachers to utilize individual instruction strategies without substantially reducing class size.

Teachers desire more education to become more proficient at what they do. Although some teachers had recently attended a mathematics and science education convention, they desire more financial support to enroll in college courses at nearby universities. Technology was listed as a need since teachers were not able to use the school's laser disk player without appropriate videodiscs. Grade 6 science teachers did not have a laboratory room to conduct experiments. Ms. Smith, who taught both mathematics and science, and other grade 6 science teachers taught science in classrooms lacking worktables or laboratory benches. Hands-on materials and activities for mathematics are desired by teachers at each grade level.

Rocket Day: A Science Assembly Vignette

A few weeks after the classroom observations, I returned to this middle school and spoke with Mr. Jones (Grade 8 science teacher) who had scheduled the annual rocket launching activity on that same day. Students launched model rockets from the center of the school football field on the school grounds. Students had constructed rockets in class from brown packaging paper, glue, and a cork cone. During this 90 minute science assembly, 12 boys gathered around the launch pads to prepare and launch rockets which the students had constructed. Mr. Jones said that girls had built rockets, yet they elected not to launch their rockets.

The majority of the eighth grade student body was assembled beyond a fence which separated the football field from an observer area with a few scattered bleachers and benches. Very few students along the sidelines appeared to pay attention to the rockets as they launched upwards to 100 feet into the air. Many students along the sidelines were busy running, jumping, and talking loudly during the rocket launching activity. A great deal of pushing, shoving, yelling, and screaming, thundered across the playing field from the boisterous crowd when a knock out-drag down fight erupted. Student bystanders ran and swerved to avoid the entangled combatants who tumbled across the ground in a great cloud of dust. A fair number of descriptive four letter words emanated from the direction of the general uproar. The fight ended with no apparent injury. It was a pleasant spring day and I believe students may have been 'feeling their oats' in this less structured outdoor school setting.

Meanwhile back at the launch site, students were firing off rockets at a rapid pace. However some rockets did not lift off the pad as expected, while other rockets deflected into errant trajectories soon after liftoff. A red, white, and blue painted rocket passed with a few feet of my head as it twisted and turned in flight. Engine exhaust left a corkscrew shaped smoke trail tracing the path of this rocket just above the ground. I was relieved when Mr. Jones said that it was time to go back into the school building.

Mr. Jones and I walked across the football field to the school building containing his remodeled classroom which was nearly complete. The room contained twelve student tables which would comfortably seat a total of twenty four students. A series of island lab benches were positioned across the room. Each lab bench was equipped with a sink and water faucets. Mr. Jones said science materials such as scales, beakers, test tubes, etc. would complete the setting but unfortunately a few empty baby food jars would have to do until supplies could be ordered. Mr. Jones could not purchase laboratory equipment for the upcoming year since the science budget had

been exhausted from the remodeling project. Numerous storage shelves and closets were found along the perimeter of the room. A storage room had been constructed between the two adjoining physical science rooms. Rear projection audio/visual equipment could be operated in this storage room and projected on a glass screen for viewing in either classroom.

Conclusions & Topics for Discussion

The mathematics and science teachers observed at this middle school taught in a didactic manner. Traditional whole group instruction prevailed in their classrooms. Textbooks and worksheets were utilized by students to learn science definitions and practice solving mathematics problems.

Concerning instructional strategies, what are the expectations of students from rural, poor, African-American backgrounds? How might teachers include a more hands-on/minds-on activity based style of instruction with large numbers of middle school students in this kind of setting? Are their differences in the way that science is learned by children from these milieus in comparison to students from other backgrounds; i.e., middle class, Caucasian students?

The science assembly activity designed for grade 8 students was an activity where few students actively participated. How might this science teacher and other science teachers in this kind of setting conduct school wide activities which involve a greater amount of student involvement? What kinds of science learning activities might these students be interested in?

How does self-esteem differ among students from various ethnic and racial backgrounds? How might teachers help students construct a positive self image to facilitate their science and mathematics learning?

Issues raised from analyzing these kinds of questions ought to facilitate deeper insight into this Florida school milieu. An understanding of teachers, students, parents, and community members beliefs about the teaching and learning of science and mathematics may help inform educational reformers about the appropriate paths to follow in diverse cultural milieus.

The great task for a central department of education like that found in Florida lies in making better sense of the rich variety of student populations enrolled in public schools. Ethnic and racial diversity ought not be considered a burden to educational reformers, rather the rich array of student populations endemic to this state, offers prime opportunities to put into practice the creed that every child has the right to a free and public education which offers her or him opportunities for individual growth and enrichment in their pursuit of happiness. The challenge of providing a meaningful mathematics and science education to Florida's diverse middle school student populations might be addressed by:

1. Learning the beliefs, practices, and needs of teachers.
2. Understanding what kinds of classroom learning environment students prefer.
3. Understanding the unique ways that individuals from racial and ethic minorities communicate.
4. Finding ways to assist students in elevating their self-esteem through their active participation in mathematics and science class activities.

A thorough analysis of these four measures just scratches the surface of understanding the learning needs of African-American students from lower socio-economic backgrounds in small town northern Florida communities. Questions remain as to how to provide a first class educational experience to children from these and other unique milieus found in Florida. Since educational reformers are intent upon improving the educational opportunities of all children regardless of student racial/ethnic or socio-economic backgrounds, then mathematics and science learning environment contexts ought to be investigated within the frame of the larger community culture in which students live.

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